

AMATEUR SATELLITE REPORT

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AO-10 Fault Diagnosis Begun

After nearly three years in orbit, AO-10 has suffered a serious malfunction. The Integrated Housekeeping Unit (IHU) experienced a memory malfunction Saturday, 17 May. The IHU is a computer that mediates overall spacecraft operation under software control. Now, diagnostic software aimed at isolating defective memory cells has been loaded and executed. Initial results are puzzling according to Command Station Ian Ashley, ZL1AOX.

According to Ian, a memory test routine was loaded into the IHU at 22:30 UTC June 1. Over the next 2 days the addresses of the faulty cells were dumped. It required an unusually long period to dump the addresses of the faulty cells. In fact all even addresses indicated an error.

This indication is inconsistent with the general hypothesis that a radiation induced memory fault is to blame since radiation induced faults tend to damage small zones of memory with each "zap". This suggests either a single point failure common to even addresses if the fault is radiation-related or to some other, more general failure mode if not radiation related.

The results of the initial memory dump indicating errors in all even addresses is being attributed to a "stuck" bit in the error correcting matrix rather than a generalized, catastrophic memory failure. Adjacent bytes, especially near the top of memory, also showed errors. Karl Meinzer, DJ4ZC, is now studying this preliminary finding. Further details of his analysis may be available the week of 8 June.

The general recovery plan envisions diagnosis and restoration of service approximately by month's end. Meanwhile, spacecraft sun angles remain excellent so there is presently no serious concern for the battery voltage.

In fact, ZL1AOX says the Mode B transponder may be on at times. When it is on, careful use is permitted. This means QRP only; less than 100 watts EIRP. The IHU routines to monitor and control high temperature and low battery voltage are not presently running so manual control is required. Unbridled use of the transponder must be studiously avoided.

AO-10 will experience perigee eclipses each orbit for the next 2 months. Until the end of June the eclipses will start between MA 7 to 9 and end between MA 14 to 22. During eclipse, both BCRs (Battery Charge Regulators) will be off and the battery voltage will drop to about 12.5 volts after

40 minutes of darkness. At present only BCR-1 is active during sunlight. The BCR-SERVICE routine is currently the only active software module running on AO-10. All other routines are loaded but will not be executed until the memory tests are completed.

Regarding spacecraft temperatures, Ian points out that channel #06, Mode B transmitter temperature, has failed and generally gives very low readings. Add 9.6 degrees to the L transmitter temperature indication to obtain a more reasonable approximation of the actual Mode B transmitter temperature. The L transmitter temperature is channel #25 in the Q block or channels A7 and D8 in the table presented in ASR #93, 31 December, 1984.

According to ZL1AOX, the present attitude of AO-10 is approximately longitude 157 and latitude 22 degrees in the Bahn coordinate system.

Phase 3C Completes Thermal Vacuum Test

Thermal-vacuum testing of the Phase 3C (P3C) spacecraft was successfully completed in Denver on Tuesday, June 3rd. The test revealed a few minor problems which are easily correctable according to test engineers. (See related Ariane V18 story) The spacecraft was then removed from the thermal-vacuum chamber at the Martin-Marietta facility and prepared for shipment on the evening of June 3rd.

Thermal vacuum testing had begun on Monday, May 26. No major problems had arisen and enthusiasm was running high among the German and American teams gathered at the AMSAT lab in Golden Colorado.

By Tuesday afternoon, May 27, the transponders had been turned on and the first QSOs took place from the Martin-Marietta club station through the satellite in the thermal-vacuum chamber about a mile away. Antennas had been placed on the roof of the building housing the chamber for these tests.

An interesting demonstration took place when Karl, DJ4ZC, using the 24 cm Mode L uplink, QSOed WA2LQQ who was on the 2 meter Mode J uplink. The J and L uplinks appeared on the combined JL downlink as monitored on 436 MHz. Both uplink frequencies were carefully selected so as to afford a coincident downlink on 436 MHz. As the two QSOers stood adjacent in the shack, they communi-

cated through the spacecraft in the chamber merely a mile away. While a far cry from the maximum on-orbit, one-way path of 25,000 miles, it was a fascinating exercise nonetheless according to the participants and the dozen or so witnesses assembled in the shack. Indeed several of those most closely responsible for the transponders were seen to grin broadly at attaining this modest yet historic milestone: the first JL QSO. (See box)

Several listeners in the Denver area reported hearing the weak Phase 3C beacons from the thermal-vacuum chamber. Due to antenna restrictions and other technical constraints, the beacon and transponder outputs were sharply padded down. Effective radiated power was in the milliwatt range. This precluded reception of the signals from the thermal-vacuum chamber for all but the closest stations and those who were line-of-sight with the building.

While the spacecraft was in the test chamber, a seminar for the P3C Ground Control team was presented by Karl, DJ4ZC. Attending were ZL1AOX, VK5AGR, KA9Q and VE1SAT. DK1YQ, also a Ground Command station, returned home to Munich earlier and will be briefed separately. The team reviewed the spacecraft architecture, systems and command procedures. Subsequent to the seminar, the various team members returned home as well.

On Saturday evening May 31st, Karl hosted a social event for those Colorado team members who had worked on various spacecraft projects. Over thirty attended and, according to Joe, WBØRLY, a good time was had by all.

Joe has been a key organizer and "doer" in the Colorado team. As Colorado Area Coordinator he had become, according to Jan King, W3GEY, "A father-figure of considerable influence and achievement within the Colorado team." Joe also obtained the task of "scribe" and issued sixteen weekly reports from Golden documenting the progress of the Phase 3C integration effort. His reports were circulated across the nation on packet bulletin boards and across the globe in ASR and the AMSAT Nets.

Joe writes in his final report, number 16, dated June 1st: "Today, the AMSAT lab at Golden was dismantled and all equipment and parts were removed. We believe we left the lab in as good condition as we found it in late June, 1985. Our thanks to the Solar Energy Research Institute (SERI) for the use of their facilities. Incidentally, their Gallium Arsenide solar cell experiment was mounted on 3C before thermal-vacuum testing and will fly with the spacecraft. Telemetry will report the performance of this developmental cell and AMSAT will report the results to the SERI as partial thanks for their hospitality."

"Phase 3C will be transported to the Martin-Marietta club station where certain modules will be removed before the spacecraft is readied for shipment to AMSAT DL. They will complete the spacecraft including mounting of the kick motor and its mounting frame, mounting of antennas, spin balancing and vibration testing. These tasks will be accomplished by our AMSAT DL colleagues at their facility in Marburg and other locations in West Germany. In addition to these tasks, some adjustments are to be made to the transponders."

"The German team is packed and ready to return to their homes tomorrow. It would be difficult to find guests who are more friendly and more capable in what they came to

The Combined JL Downlink

After operation through P3C begins in space, experienced Mode L users will easily communicate with beginner Mode J users through the facility of the new JL concept. Many feel this cross-mode type of transponder affords a "neat" solution to the problem of pressing ahead with technology at UHF and higher while preserving the link with "starter" modes. Historically, Mode A had been seen as a "starter" mode. With AO-10, Mode B has largely become the entry level mode. With P3C, Mode J and Mode B could be entry level modes with Mode L becoming "mainstream" in a year or two. Meanwhile, Mode S is well out front pushing the technology and the user community alike.

do. All of us in the Colorado team enjoyed their stay and wish them a safe return.

"Finally, a special mention for Jan King, W3GEY, and Karl Meinzer, DJ4ZC. As prime movers in the Phase 3 series of spacecraft, their pioneering efforts have given the International AMSAT effort a brand of Amateur Satellites that has vastly furthered the hobby. We look forward to their next creation."

"This completes this series of reports. It is apparent that a path for adequate communications with AMSAT DL has been opened with their new T-Mail status. We look forward to hearing their reports on P3C as their windup efforts proceed."

"Good luck with the launch and 73 to all, Joe, WBØRLY"

AMSAT expresses its sincere thanks to all those in the Colorado P3C Integration Team who made this effort work and to Joe, WBØRLY, who provided an invaluable perspective on the goings-on! AMSAT similarly expresses its deep thanks to the many others who have contributed so much to date!

Ariane V18 Launch Failure Will Delay P3C Launch

The launch failure of a European Space Agency Ariane-2 rocket Friday night, 30 May, has sent an already reeling space launch industry into an unprecedented regime of confusion and concern.

A third stage failure is being blamed for the fourth Ariane failure in 18 launches. This is the fourth major Western launch disaster of the year. It comes on the heels of the Shuttle disaster in January, a USAF Titan 3D failure in April and a NASA Delta crash in early May. According to Arianespace, the third stage of its ill-fated launch failed to ignite. This forced the range safety officer to destroy the launcher and its \$55 million Intelsat V satellite payload just over 4 minutes into the mission.

Arianespace immediately suspended all plans for future launches pending investigation of the V18 failure. Accord-



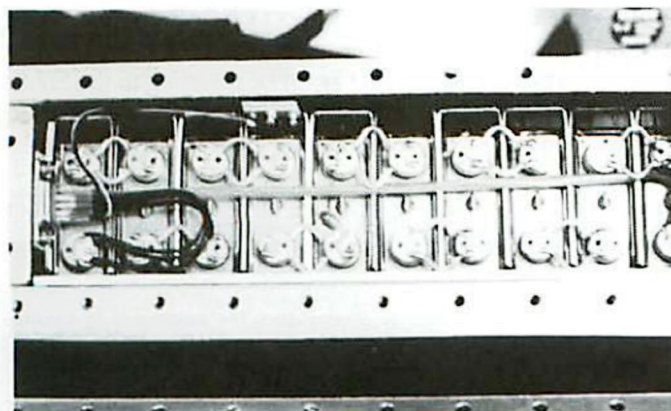
Bruce Rahn, WB9ANQ, explains some "do's and don'ts" about preamplifiers to the Beginner's Forum at Dayton.

ing to a senior Arianespace official, "The [overall launch] situation has gotten about as bad as anyone could have imagined." He referred to the extraordinary string of disasters this year which have hobbled the launch business and now completely ravaged the launch insurance business. "Space is still a risky business," he observed.

AMSAT is manifested to fly the first Ariane-4 launcher, the V21 mission. This launch had been scheduled for early November. However, it is now seems virtually certain the launch of Phase 3C aboard the V21 mission will be pushed into 1987. Arianespace officials said it would be at least 2 months and up to 6 months or more before launches could resume.

AMSAT officials expressed hope the future launch schedule will clarify soon. Meanwhile, these officials suggested AMSAT may take advantage of the schedule slack to effect some improvements in specific P3C areas.

For example, while improvements in the IHU radiation hardness has been discussed for months, even before the current IHU failure episode unfolded in May, a tight schedule limited what efforts might be brought to bear on the problem of a possible memory replacement. Now, with an apparent launch stand-down of several months at hand, serious consideration is being given to rebuilding the P3C IHU with newer, harder memory chips and simultaneously increasing memory capacity from the current 16k to 32k. The



Phase 3C main battery prior to case closing.

result could be increased P3C reliability, capability and flexibility.

The delay in the launch may also allow refinement of other hardware matters that at present require "tweaking." For example, the Mode S transponder efficiency might be raised a few percent. Currently it is a bit under specification. An improvement in DC to rf efficiency might result in its being on the air longer when in orbital operation. Other "fine tuning" efforts may now be possible throughout the various sub-systems to further take advantage of any schedule slack.

Meanwhile, the satellite launch business is in virtual turmoil with several year's backlog of orders and no currently viable launch system in the Western world. The Soviet Union together with Japan and recently the People's Republic of China remain the only launchers not currently on hold because of recent launch failures. (India has a growing space launch program and Brazil is moving towards a program).

Authorities in the satellite communications business commented that current demand is being met with existing systems. But, they hasten to add, a satcom capacity shortfall due to recent launcher failures is inevitable beginning in a couple of years and extending well into the next decade.

Glitch Puts UoSAT OSCAR 9 Off The Air

According to Martin Sweeting, G3YJO, UO-9 went off the air in early June for reasons which are not entirely clear at press time.

Apparently a problem associated with the DIARY software package developed. Diagnostics were run and various error paths are being checked to isolate the fault. The error seems to have been corrected since UO-9 was returned to service by 6 June.

Amateur Satellite Report To Be Sent To All AMSAT Members

Preparations are nearing completion to effect a major change in AMSAT's publications program. Effective later this month *Amateur Satellite Report*, ASR, will replace *Satellite Journal* as AMSAT's flagship publication. *Satellite Journal* in turn will be replaced by a new, optional monthly publication jointly published by AMSAT and another major domestic publisher.

ASR will continue as a bi-weekly for the immediate future. Current ASR subscribers will receive certificates of credit towards future AMSAT publications.

An Autumn 1986 kickoff is planned for the new, optional monthly technical magazine. Being an AMSAT member will afford the subscriber to this new magazine a generous, preferential subscription rate.

AMSAT has issued a call for articles for the new magazine. Send manuscripts to AMSAT, P.O. Box 27, Washington, D.C., 20044. Good graphic content is important. Your inclusion of good quality photos, together with graphs and line drawings all help make your article more attractive and interesting. Graphic content notably enhances the likelihood of acceptance of your manuscript for publication.

The success of the new magazine is closely tied to the quality of the articles it publishes. And the articles inevita-

bly must originate largely within the satellite community. Your participation is strongly encouraged!

Call For Nominations

AMSAT Headquarters announces nominations for the office of Member of the Board of Directors are now in order. The seats of three directors (Thomas Clark, W3IWI, Vern Riportella, WA2LQQ, and Harry Yoneda, JA1ANG) are up for election in this cycle. Last November four directors — John Henry, VE2VQ, Jan King, W3GEY, John Browning, W6SP, and Harold Price, NK6K — were elected. The term of office is two years. An AMSAT member who agrees to serve can be nominated by any five current AMSAT members or by an AMSAT member society. Nominating petitions may be sent to: AMSAT, P.O. Box 27, Washington, DC 20044. Petitions must arrive at AMSAT not later than July 31, 1986. Nominees will be asked to provide minimal background and biographical data for inclusion with the ballot forms.

JAS-1 Launch Details

With the launch of the first all-Japanese satellite, JAS-1, now less than two months away, details of the launch and initial orbital elements are being released.

Launch is currently scheduled at 2030 UTC, 31 July 1986 according to a note by James Miller, G3RUH, with acknowledgement to "OSCAR News".

The following Keplerian elements have been supplied for JAS-1:

Ref Epoch: 86212.897306 UTC
Inclination: 50.004 deg
RAAN: 237.456 deg
Eccentricity: 0.0001407
Arg. of Per: 2.155 deg
Mean Anomaly: 330.246 deg
Mean Motion: 12.412719 rev/day
Decay: 0 rev/day/day
Epoch Rev: 0
SMA: 7879.56 km
Beacon: 435.795 MHz

Real-time launch coverage is being planned with audio transmitted on hf. As in the past, an AMSAT Launch Information Net Service, ALINS, is planned to cover the launch in real-time. This special JAS-1 ALINS (J-ALINS) is being coordinated by JAMSAT President Harry Yoneda, JA1ANG and AMSAT's VP for Operations Ralph Wallio, WØRPK. JA1ANG is also an AMSAT Director.

Additionally, according to Eric Rosenberg, WA6YBT, the Goddard Amateur Radio Club in Maryland plans to continue its on-the-air launch coverage from the club station WA3NAN. The Goddard club has provided yeoman service in covering shuttle launches in the past. Club President

Frank Bauer, KA3HDO, reported WA3NAN activities at the AMSAT forum at the Dayton Hamvention in April.

Yearbook Photos Now Sought

Photos may now be submitted for possible inclusion in the AMSAT-OSCAR 25th Anniversary Yearbook. Do you have a favorite photo of you and shack? Do you have one which shows your satellite station as it was ten years ago? Twenty? Or even last month? If so, you are invited to submit them for possible inclusion in the yearbook.

Please submit all photos with suitable captions carefully written on labels affixed to the rear of the photos. Do not use ball point pen as this could smear onto other photos.

Please include a SASE for return of the photos.

Send candidate photos to: Yearbook, P.O. Box 177, Warwick, NY 10990.

Net Survey Extended Through June

The AMSAT Net Survey has generated hundreds of responses and many are quite informative. The value of the suite of AMSAT nets to many users has been underscored and many helpful suggestions have been made by respondents. The survey will be extended through the month of June to allow additional time for response.

AMSAT is interested in knowing where you receive information about satellite activity and what AMSAT nets you may listen to. Your response will be welcomed and rewarded with a handy Phase 3C and JAS-1 frequency guide. Simply send your net listening report together with a business sized SASE to: Net Survey, P.O. Box 177, Warwick, NY 10990.

Since the Phase 3C satellite frequencies will not be precisely known for a few more weeks, the frequency guides will be mailed as soon as the exact values are firm.

Short Bursts

- The launch of RS-9 and RS-10 is now put in the July-August time frame. The launch of ISKRA-4 has also been postponed due to the end of the school year. ISKRA-4 is being built by students at the Moscow Aviation Institute. The students are now on summer break.
- An English language translation of the new JARL JAS-1 Handbook is now available from Project OSCAR. Send \$10 to: JAS-1 Satellite Handbook, Project OSCAR, Inc, P.O. Box 1136, Los Altos, CA 94023
- Ross Forbes, WB6GFJ, will again be traveling to the South Pacific this year on a DXpedition. He will be operating primarily hf in the 20 meter band. If AO-10 is in service, he will operate on the satellite as FOØFB from July 10th to July 17th from Tahiti. Watch 145.900 SSB and QSL direct with SASE or SAE and IRC.

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